

Land at Barnham, Eastergate and Westergate (BEW Parcel SC1) Environmental Statement

Chapter K: Water Environment and Drainage

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K1.0 Introduction

- K1.1 This Chapter forms part of an Environmental Statement ('ES') which sets out the findings of an Environmental Impact Assessment ('EIA') of the proposed residential led mixed use development of land near the villages of Barnham, Eastergate and Westergate ('BEW') in West Sussex. The proposals also include the realignment of the A29 strategic route south of Barnham Road.
- K1.2 The Proposed Development forms a first phase of a wider strategic allocation of land which is known for the purposes of this ES as 'BEW Parcel SC1'. A description of the background to the proposal, including its role as part of the strategic allocation; the relationship of this chapter to the wider ES; and a description of the site and the development is provided at Chapters A to C of this ES.
- K1.3 Chapter N considers cumulative effects including a review of the potential for effects associated with the development of the wider strategic allocation at BEW.
- K1.4 This chapter should be read in conjunction with Chapters A, B, C and N.
- K1.5 This Chapter reports the assessment of the potential for likely significant environmental effects arising from the Proposed Development in relation to flood risk and drainage. It describes the baseline conditions and the likely significant effects, as well as water quality and hydrological issues associated with the Proposed Development.
- K1.6 The Assessment identifies the baseline environment and key receptors within the study area in the context of the Water Environment. It describes the methods used for baseline surveys; summarise the consultation; thereafter reviewing and assessing the likely significant impacts of the Proposed Development.
- K1.7 The Assessment covers the likely effects during both the construction and operation stages and evaluates the significance of these effects. Mitigation is identified to prevent, reduce or offset any significant adverse effects associated with flooding, drainage and the water cycle of the Proposed Development. Potential residual effects after the adoption of mitigation measures be assessed, to understand their cumulative impact within the development and with other committed schemes elsewhere. The cumulative assessment is presented in Chapter N.
- K1.8 This chapter is supported by the following technical appendices:
- **Appendix K1 – Flood Risk Assessment**
 - **Appendix K2 – Sustainable Drainage Report**
 - **Appendix K3 – HEWRAT Analysis**

About the Author

- K1.9 This Chapter has been prepared by Pell Frischmann as competent experts and should be read in conjunction with the Flood Risk Assessment, Sustainable Drainage Report and HEWRAT Analysis contained as technical appendices. The chapter has been prepared by Thomas Sturtridge BSc (Hons) MSc GradIEMA and Daniel Allum-Rooney BSc (Hons) MSc GradCIWEM, Drainage & Flood Risk Technical Director. Thomas has recently completed a Masters degree in Sustainability and Environmental Management. Daniel has over 13 years' experience in the field of environmental consultancy and has prepared ES Chapters to support successful planning applications for numerous developments including sustainable urban extensions and nationally significant infrastructure projects across the UK.

K2.0 Policy Context

Legislative Framework

K2.1 In preparing this section of the Environmental Statement, relevant national and local legislation and policy guidance documents have been consulted and presented. An overview of the applicable legislative framework is summarised as follows (all as amended):

- Environment Protection Act 1990 – Part IIA of the Act describes a regulatory role for local authorities in managing contaminated land and as of 2008, makes provision for improved control of pollution arising from certain industrial and other processes, re-enacting the provisions of the Control of Pollution Act 1974.
- Water Resources Act 1991 – The Act sets out the regulatory restrictions on abstraction and compounding of water.
- Water Industry Act 1991 – Reinforces enactments regarding water supply and sewerage services.
- Land Drainage Act 1994 – The Act consolidates enactments where duties are placed on the Internal Drainage Board (IDB) and local authorities regarding land drainage and includes additional environmental duties to the previous Land Drainage Act 1991.
- The Environment Act 1995 – The Act sets new standards for environmental management and presents the responsibilities of the Environment Agency pertaining to water pollution, flood defence and resource management.
- The Water Framework Directive 2000/60/EC (was transposed into English law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003), which were replaced in 2017 – those regulations are now retained EU law. The WFD is designed to improve and integrate the way water bodies are managed. It effectively incorporates and/or supersedes all water related legislation that drives the existing consenting framework.
- Water Act 2003 (as amended) – Formalises the Government's commitment to the sustainable management and use of water resources and sets out measures for flood defence work in England and Wales.
- The Groundwater Directive 80/68/EEC was transposed into English law through the Groundwater (England and Wales) Regulations 2009 – Sets out to protect groundwater against pollution by 'List 1 and 2' Dangerous Substances. The relevant regulations are now the Environmental Permitting (England and Wales) Regulations 2016 (as amended).
- Flood and Water Management Act 2010 – This legislation responds to pressure to address the threats of flooding and water scarcity, which are both expected to increase with climate change. It recommends that Sustainable Drainage Systems (SuDS) should be the first choice for drainage for all new developments, and that the SuDS Approval Body within the LLFA have a duty to adopt SuDS (subject to approval).
- Environment Act 2021 – A bill to make provisions about targets, plans and policies for improving the natural environment, including water, wastewater, nature and biodiversity.

National Policy

National Planning Policy Framework (NPPF)

K2.2 The revised National Planning Policy Framework was updated in July 2021 and outlines the Government's planning policies for England.

K2.3 Section 2 introduces a presumption in favour of sustainable development (Paragraph 11). In the context of flood risk and drainage, the Framework states that the planning system should aim to minimise vulnerability and impose resilience to effects arising from climate change, such as increased flood risk and coastal change. Therefore, it should seek to:

- Deliver reductions in greenhouse gas emissions;
- Avoid inappropriate development in areas at high risk of flooding or where development is necessary, provide measures to minimise the flood risk;
- Reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical change to the coast;
- Consider the long-term implications for flood risk, coastal change and water supply.

K2.4 Section 14 of the NPPF further covers how planning policy should meet the challenges of climate change, flooding, and coastal change.

Planning Practice Guidance

K2.5 Last updated in June 2021, the online-based Planning Practice Guidance was introduced to support the NPPF. This guidance provides specific mention of flood risk and coastal change issues. Table 1 of the Planning Practice Guidance defines Flood Zones whilst referring to the Environment Agency's Flood Map for Planning.

K2.6 Table 2 defines the flood risk vulnerability classification of different land uses. Further guidance is also provided regarding appropriate allowances for climate change and ways to manage residual flood risk.

Local Policy

Adopted Arun Local Plan

K2.7 The Arun Local Plan 2011-2031 was adopted by the Council in July 2018, setting out the vision, objectives and a sustainable strategy for delivering the necessary growth of the District over the Plan Period.

K2.8 Specifically, Chapter 18 of the Local Plan addresses 'Water' with its strategic objective "*To plan for climate change and work in harmony with the environment to conserve natural resources and increase biodiversity.*".

K2.9 The following list provides a summary of the key policies related to the water environment:

- 1 Policy W SP1 – This relates to water in many forms and includes encouraging water efficiency measures to protect water resources and water quality. It also promotes the incorporation of SuDS as part of a surface water strategy using them as design features to enhance waterbodies and provide flood relief.
- 2 Policy W DM1 – This policy relates specifically to water supply and quality, stating development will only be permitted where sufficient water supplies can be provided and not considered detrimental to existing resources. It also requires demonstration of adequate drainage capacity in the foul and surface water network. Specific advice is provided regarding any discharges to the Lidsey Wastewater Treatment Works catchment.
- 3 Policy W DM2 – Relates to flood risk issues, setting out a range of criteria that must be met for development to be permissible. Development must demonstrate adequate management of flood risks identified and contribute to sustainability benefits to the wider community, including a reduction in flood risk where possible.

- 4 Policy W DM3 – Focusses on the provision of SuDS to capture and store water on site that will also aid in improving water quality. Specific policy points relate to the suitable inclusion of SuDS measures and design criteria that should be met. These policy points align with the Local Surface Water Management Policy prepared by West Sussex County Council, discussed below.
- 5 Policy W DM4 – Outlines policy points centred on protecting the coast and providing sea defence works. Due to the location of the Proposed Development, this policy is unlikely to be directly relevant to the assessment.

Barnham Eastergate and Westergate (BEW) Framework Masterplan (2020)

- K2.10 The BEW Framework Masterplan was produced to provide a comprehensive masterplan for the strategic site allocation, demonstrating how the site can contribute to the delivery of housing and employment needs of the Local Plan through the plan period (2011-2031).
- K2.11 Specifically, the Framework Masterplan sets out flood risk constraints in relation to the network of ditches across the site and published Flood Zone extents along the Lidsey Rife corridor. It also outlines a comprehensive strategy for surface water management across the Framework Masterplan area in line with the requirements and recommendations of the Arun Strategic Surface Water Management Study.
- K2.12 The Framework Masterplan was endorsed by the Council's Development Control Committee in November 2020, subject to the submission of a Phasing and Infrastructure Delivery Plan.

Strategic Flood Risk Assessment

- K2.13 Arun District Council prepared a Strategic Flood Risk Assessment^{Error! Reference source not found.} as appropriate supporting evidence for the (then) emerging Local Plan. The SFRA is to be used in decision-making and to inform suitability of future development when considering policies for the long-term management of flood risk.
- K2.14 The SFRA specifically assesses the Proposed Development site due to its allocation in the Local Plan, referred to within the SFRA as 'Barnham / Eastergate / Westergate (BEW)'. It therefore provides a wealth of background information and assessment of key flood risks, in addition to specific recommendations and measures that should be incorporated in future development.

Preliminary Flood Risk Assessment

- K2.15 The Preliminary Flood Risk Assessment^{Error! Reference source not found.} is a high-level overview of flood risk across the County. It considers past flooding incidents, best available information and possible future flood risks from local sources. These include surface water runoff, groundwater, ordinary watercourses and flooding from canals and small waterbodies.
- K2.16 The PFRA was prepared to meet the duties required of West Sussex County Council as Lead Local Food Authority per the Flood Risk Regulations (2009).
- K2.17 It provides valuable information on historic flood events and local flood risk issues to inform the risk to the site as well as impacts elsewhere.

Lidsey Surface Water Management Plan

- K2.18 Following several flood events in West Sussex County during 2012 and 2013, West Sussex County Council made a resolution to address issues regarding drainage infrastructure as part of

‘Operation Watershed’. A key output of this was the creation of the Lidsey Surface Water Management Plan³ that outlines how surface water should be managed within this catchment.

- K2.19 The entire application site falls within the Lidsey Surface Water Management Plan area, and as such this amendment uses the information contained in the plan to advise on baseline conditions in relation to local flood risk. Where relevant, specific policies and recommendations for the management of surface water are incorporated into the design and assessment of the Proposed Development as part of the Flood Risk Assessment and Sustainable Drainage Report.

SuDS Guidance

- K2.20 West Sussex have prepared a specific policy document⁵ related to surface water management in new developments. This guidance has been used as a foundation for developing the surface water drainage strategy for the Proposed Development.
- K2.21 As such, there is inherent mitigation designed into the scheme to ensure compliance with this local policy.

Catchment Flood Management Plan

- K2.22 The Arun and Western Streams Catchment Flood Management Plan⁴ has been prepared by the Environment Agency as a document that considers all types of inland flooding to establish sustainable flood risk management policies for the long term.
- K2.23 In particular, the Proposed Development is within the Sub-Area called “Coastal Plains and East Wittering – Sub-Area 6”. In this regard, Policy 4 of the CFMP applies, which states:
- “Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change”*
- K2.24 Further information on how this policy relates to the Proposed Development is incorporated within this document where appropriate, and the implications discussed within the Flood Risk Assessment (Appendix K1).

K3.0 **Assessment Methodology & Significance Criteria**

Assessment Methodology

- K3.1 A Flood Risk Assessment has been carried out in accordance with the guidance of the National Planning Policy Framework and associated Planning Practice Guidance. It also includes reference to updated guidance published by the Environment Agency (July 2020) on climate change allowances⁷ that should be used as part of an FRA.
- K3.2 Overarching guidance related to surface water drainage includes the Non-Statutory Technical Standards for Sustainable Drainage Systems, West Sussex County Council's Policy on the Management of Surface Water and the CIRIA SuDS Manual⁶.
- K3.3 With reference to this Environmental Statement, the significance of each potential impact identified will be measured through a qualitative assessment, combining the sensitivity of each receptor and the magnitude of each impact in a matrix.
- K3.4 Where possible, quantitative measures of a resource or receptor have been used to inform the receptor sensitivity classification, otherwise expert judgement, observations and available information have been used to make an informed decision.
- K3.5 The sensitivity classifications being used are summarised in Table K3.1.

Table K3.1 Receptor Sensitivity Definitions

Sensitivity	Description	Quantitative Measures
Very High	Very high importance and rarity, receptor is defined on an international scale or importance with very little opportunity for substitution.	High Overall WFD Classification Principal Aquifer Source Protection Zone I Flood Zone 3b Local Population
High	Receptor defined on a national scale or having national importance, with limited potential for substitution.	Good Overall WFD Classification Secondary A Aquifer including local groundwater Bathing Water Source Protection Zone II Flood Zone 3a Existing Residential Properties
Medium	Medium importance and/or rarity, defined as having a regional importance with some potential for substitution or replication.	Moderate Overall WFD Classification Secondary B Aquifer Source Protection Zone III Flood Zone 2 Existing commercial/retail property
Low	Low rarity and importance defined on a local scale, or a receptor that could be substituted without concern.	Poor or Bad Overall WFD Classification Unproductive Aquifer Source Protection Zone of Special Interest Undeveloped land
Negligible	Receptor of very low importance or rarity that may not require substitution.	Flood Zone 1

- K3.6 Each impact identified as part of the technical assessment can be quantified in terms of its magnitude of impact as per the definitions in Table K3.2. It should be noted that the magnitude of impact can be either beneficial or adverse.

Table K3.2 Magnitude of Impact Definitions

Sensitivity	Description
Major	Substantial change in defining characteristics of resource, including quality and/or extent. Impacts are measurable and likely to change the integrity, viability or operation of a resource.
Moderate	Measurable change in at least one key feature or defining element of a resource, such as change to quality or scale. Impacts may have potential to affect the overall integrity of the resource.
Minor	Measurable change to an attribute that may not affect the overall classification or definition of the feature. Impacts are unlikely to affect the overall integrity or nature of the resource.
Negligible	Small change to a key characteristic may be predicted but unlikely to be observed or result in measurable change to the quality or extent of the resource.
No Change	No discernible change to the characteristic features or defining elements.

Significance Criteria

- K3.7 The receptor sensitivity and impact magnitude are then combined within the significance matrix to define the significance of effect as per Table K3.3.

Table K3.3 Significance Matrix

		Impact Magnitude				
		Major	Moderate	Minor	Negligible	No Change
Receptor Sensitivity	Very High	Substantial	Substantial	Moderate	Minor	None
	High	Substantial	Moderate	Moderate	Minor	None
	Medium	Moderate	Moderate	Minor	Minor	None
	Low	Minor	Minor	Minor	Neutral	None
	Negligible	Neutral	Neutral	Neutral	Neutral	None

- K3.8 In the context of this Environmental Statement chapter, a 'significant effect' is considered one that is assessed as having 'substantial' or 'moderate' significance, as defined in Table K3.4.

Table K3.4 Definition of Significance

Significance	Description
Substantial	These effects are usually associated with significant changes to resources of an international importance or attributed to large-scale impacts on a nationally significant resource.
Moderate	These effects may be important and require mitigation and may be key in the decision-making process. The cumulative impact of several effects of this significance on a receptor may influence decision-making if they lead to an increase in the overall impact.
Minor	These effects may be raised as important on a local scale but are unlikely to be critical in the decision-making process but may be important factors in enhancing the subsequent design and mitigation of the project.

Significance	Description
Neutral	No discernible effects, or those the scale of which can't be accurately measures. Impacts likely to be within the normal limits of variation or within the margin of error of assessment methods.

Consultation

K3.9

Consultation has been ongoing with the key stakeholders since early October 2019 regarding various matters related to flood risk, drainage and water resources. A summary of the consultation is provided in Table K3.5. It should be noted that when referencing the Lead Local Flood Authority, this includes representatives from both West Sussex County Council and Arun District Council, who have devolved powers from the County Council on various matters.

Table K3.5 Water Environment Consultation Log

Consultee	Type of Consultation	Response
Environment Agency	Request for Information	Provided relevant flood risk data in respect of Lidsey Rife
	Technical Meeting – July 2020	Pre-application engagement to discuss scope of flood risk assessment, particularly potential impact, and design requirements of A29 crossing over Lidsey Rife.
	Scoping Report Response	Identified the requirement for a Flood Risk Assessment and for work to assess the impacts of the A29 crossing over the Lidsey Rife. Also welcomes intention to daylight culverted watercourses. Other matters related to ecology are discussed within relevant chapter of ES.
Lead Local Flood Authority	Request for Information	Information supplied, including GIS files of ADC assets (sewers, watercourses, highway drains).
	Technical Meeting – November 2019	Inception meeting to discuss scope of project, emerging surface water strategy and agree key principles.
	Technical Meeting – February 2020	Presentation of interim groundwater monitoring data, and progression of overall strategy.
	Technical Discussion – November 2020	Presentation of full 12 months of groundwater monitoring data, report of progress of surface water strategy and discuss infiltration testing requirements.
	Scoping Report Response	Confirmation development needs to 'make space for water' including use of aboveground SuDS and daylighting watercourses. Design standards for drainage and infiltration also provided as is needed for carrying out Winter infiltration testing.
Southern Water	Pre-Development Enquiry	Early identification of need for strategic foul water infrastructure upgrades to serve development.
	Technical Meeting – December 2019	Inception meeting to discuss scale of project, potential phasing, and emerging strategic options for foul water disposal.
	Technical Meeting – March 2020	Progress update, including Southern Water's commencement of exercise to assess viability and feasibility of strategic solution options.
	Technical Meeting – September 2020	Progress update, with Stage 1 completed by Southern Water. Southern Water continue to assess options for providing foul water disposal.
	Scoping Report Response	Response includes confirmation that assets exist within the application boundary and should be duly considered.

Consultee	Type of Consultation	Response
		Other items are raised in regard of appropriate methods to dispose of surface water and to engage with Southern Water in respect of identifying suitable points of connection and capacity within the foul water network.
Portsmouth Water	Scoping Report Response	Response confirms Portsmouth Water have no adverse comments from a groundwater quality protection perspective as the site is outside a source protection zone.

Assumptions and Limitations

- K3.10 The scope of the assessment has been based upon a review of available information within the study area to identify the baseline conditions and development receptors. This has been supported by detailed assessments where necessary and is based on the best data available at the time of production.
- K3.11 Discussions are ongoing with Southern Water in respect of a strategic solution to accommodate foul water disposal from the Proposed Development. Whilst this process remains ongoing, it is assumed that a viable solution is deliverable and will meet with Southern Water's obligations under the Water Industry Act (1991) to provide such a service within any environmental permitted limits, thus negating any impact on the wider water environment.
- K3.12 Furthermore, whilst the principles of the drainage strategy prepared for each element of the site are compliant with current best practice and guidance, the nature of an outline application means that these strategies may be subject to change during detailed design at reserved matters to reflect any updated design requirements.

K4.0 Baseline Conditions

K4.1 This section provides a breakdown of the baseline conditions currently found at the site, including receptors and how these receptors interact with the site and the resultant drainage and flood risk constraints. Some of the key receptors are as follows:

- Lidsey Rife
- Pagham Harbour
- School Stream
- Barnham Rife
- Bognor Regis Coastline
- Groundwater
- Lidsey WwTW

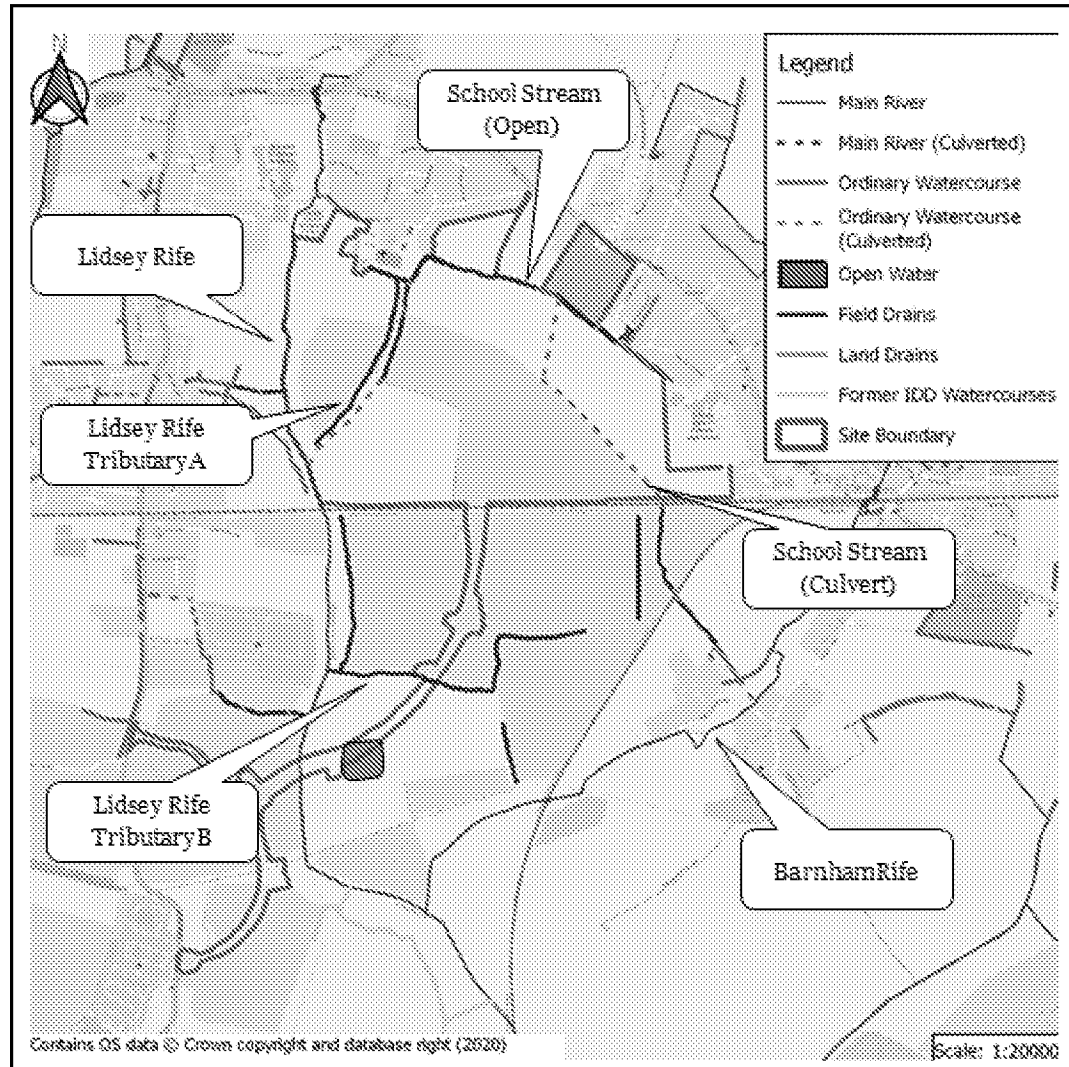
Existing Conditions

K4.2 The Application Site is predominantly given over to agricultural land, dominated by arable fields. The Lidsey Rife comprises a dominant topographical feature in the landscaping running through the western part of the site. A series of smaller, interconnected engineered watercourses are present within the site, serving a predominant land drainage function (see Figure K4.1).

K4.3 Along the northern boundary, a watercourse referred to as the 'School Stream' flows both east and west to a point where a headwall is present. This headwall leads into a culverted section of watercourse that re-emerges just north of the railway line in the east of the site, before passing under the railway and continuing its route as an open watercourse.

K4.4 Within the Application Site boundary, there are no areas considered to be served by existing positive drainage infrastructure, and as such, the entire area is subject to a natural regime of surface water runoff, evapotranspiration, and infiltration where ground conditions permit.

Figure K4.1 Watercourse Location Plan



Surface Water Receptors

- K4.5 As per the South East River Basin Management Plan (RBMP), the site falls within the 'Lidsey Rife' surface water body catchment. Therefore, any smaller watercourses or tributaries on site effectively contribute towards or affect the quality, mitigation and management of this water body.
- K4.6 Downstream, the Lidsey Rife discharges into another surface water body known as the 'Aldingbourne Rife', which may experience indirect effects due to its hydrological connectivity and relatively short distance from the site boundary.
- K4.7 The 'Aldingbourne Rife' surface water body then discharges to the 'Sussex' coastal water body, which again may experience indirect effects.
- K4.8 Discussions are ongoing with Southern Water and it is likely that foul flows may be directed to Ford Wastewater Treatment Works, that outfalls via a small tributary to the River Arun transitional water body and so is also included within the scope of this assessment.

- K4.9 Key classification information for the respective water bodies is summarised in Table K4.1. Information regarding WFD classifications of the below mentioned watercourses was taken from the DEFRA and Environment Agency Catchment Data Explorer⁹.

Table K4.1 Local Waterbody Status Classification

	Overall Status				
	2013	2014	2015	2016	2019
Lidsey Rife – Overall	Moderate	Moderate	Moderate	Moderate	Moderate
<i>Ecological</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>
<i>Chemical</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Fail</i>
Aldingbourne Rife – Overall	Bad	Poor	Poor	Moderate	Moderate
<i>Ecological</i>	<i>Bad</i>	<i>Poor</i>	<i>Poor</i>	<i>Moderate</i>	<i>Moderate</i>
<i>Chemical</i>	<i>Fail</i>	<i>Fail</i>	<i>Good</i>	<i>Good</i>	<i>Fail</i>
Sussex – Overall	Moderate	Moderate	Moderate	Moderate	Moderate
<i>Ecological</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>
<i>Chemical</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Fail</i>
Arun Transitional - Overall	Moderate	Moderate	Moderate	Moderate	Moderate
<i>Ecological</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>
<i>Chemical</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Good</i>	<i>Fail</i>

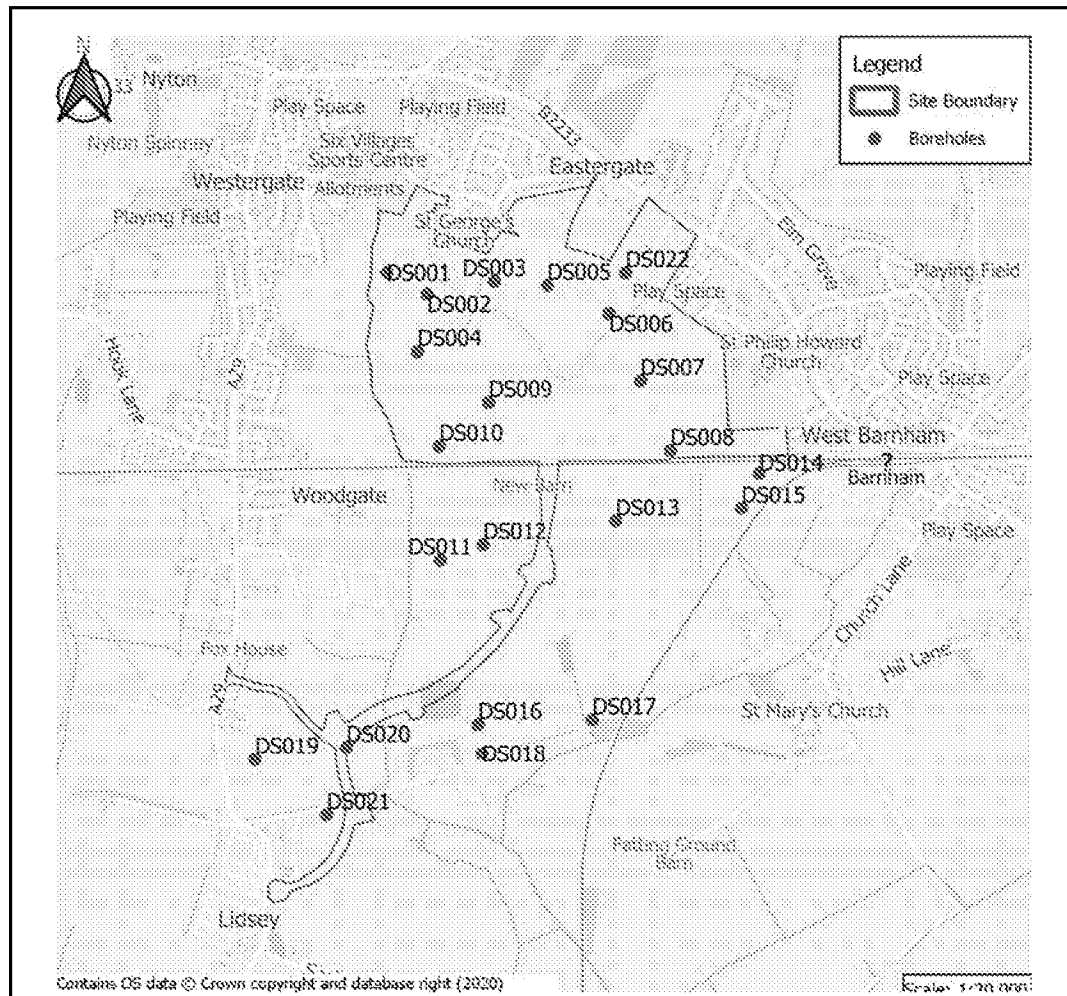
- K4.10 The coastal areas around Pagham and Bognor Regis fall within the remit of the Bathing Water Directive and so are afforded additional Protected Area designations.
- K4.11 For the Lidsey and Aldingbourne Rifes, the water body mitigation measures from the RBMP both detail sewage discharge as a reason for not achieving good status attributed to the 'Water Industry', referring to discharge from treatment works. This particularly affects chemical and physico-chemical classification elements including phosphorous and dissolved oxygen.
- K4.12 Poor nutrient and soil management are also listed in the RBMP record as reasons for not achieving good status related to the same classification elements. As such, removal of these activities within the catchment may go some way to mitigating the baseline conditions.
- K4.13 Based on the current classifications and referring to the receptor sensitivity definitions in Table K3.1, the Lidsey Rife, Aldingbourne Rife and Arun Transitional water bodies would all be considered as a 'Medium' sensitivity receptor.
- K4.14 Due to the protections afforded under the Bathing Water Directive, the 'Sussex' coastal water body would be considered a 'High' sensitivity receptor.
- K4.15 Referring directly to watercourses on site, those that serve a land drainage function that would essentially be redundant following development of the site would be considered a 'Low' sensitivity receptor. Those that serve a wider catchment, but that are not explicitly defined in the RBMP such as the School Stream, would be considered 'Medium' sensitivity receptors.

Groundwater Receptors

- K4.16 Aquifer designations within the superficial deposits covering the Development Site are categorised as 'Superficial A' aquifers with a Medium-low groundwater vulnerability. The bedrock geology is designated as an 'Unproductive' aquifer. The Development Site is not within

- a Source Protection Zone with the closest located approximately 0.9km away around Aldingbourne CP and approximately 1.6km away around Tangmere CP.
- K4.17 The Development Site does not lie within the boundary of the nearby 'Littlehampton Anticline West' or 'Sussex Lambeth Group' ground water body as part of the South East groundwater management catchment.
- K4.18 DEFRA's MagicMap mapping suggests the site has a medium-low groundwater vulnerability suggesting it is not as susceptible to being polluted as other areas and has a medium priority for phosphate issues under the Countryside Stewardship Agreements as part of the England Rural Development programme. This aims to help improve water quality in areas identified to meet WFD targets.
- K4.19 Groundwater monitoring has been operational across the site and wider Framework Masterplan area since October 2019 to record observed groundwater levels in line with local policy outlined by West Sussex County Council and Arun District Council. In total 22 boreholes were installed in locations as per Figure K4.2.
- K4.20 Groundwater level readings were taken approximately twice a month over the Winter period (October 2019 – March 2020) and then broadly monthly until monitoring ceased (April 2020 – December 2020).
- K4.21 This monitoring suggests Winter groundwater levels for October 2019 to March 2020 typically ranged from 3.82m to 0.05m below ground level (bgl) although in some cases groundwater was not struck and the borehole at that specific monitoring time was recorded as 'Dry'. A more thorough analysis of the groundwater levels and its implications on flood risk is provided within the Flood Risk Assessment (Appendix K1). In the context of this ES Chapter, it can be concluded that the groundwater resource beneath the Development Site is close to the surface during the Winter but is extensive and in continuity with groundwater levels across the district.
- K4.22 There is a defined link between the areas with the highest groundwater level and proximity to the Lidsey Rife, which flows through the Development Site. The areas of shallow groundwater appear near to the river suggesting a flow from the groundwater to the river and vice versa. This may lead to an increase in groundwater flood risk when the river is in spate.
- K4.23 These results are generally in keeping with wider groundwater monitoring carried out across the district by Arun District Council and correlates with the site observations by Pell Frischmann's drainage engineers.
- K4.24 Due to the 'Secondary A' aquifer designation and the potential for locally monitored groundwater levels to be 0.05m bgl, groundwater is considered to be a high sensitivity receptor. Its shallow presence and connectivity to a wider aquifer including local watercourses means that any impact on this receptor could be far reaching.

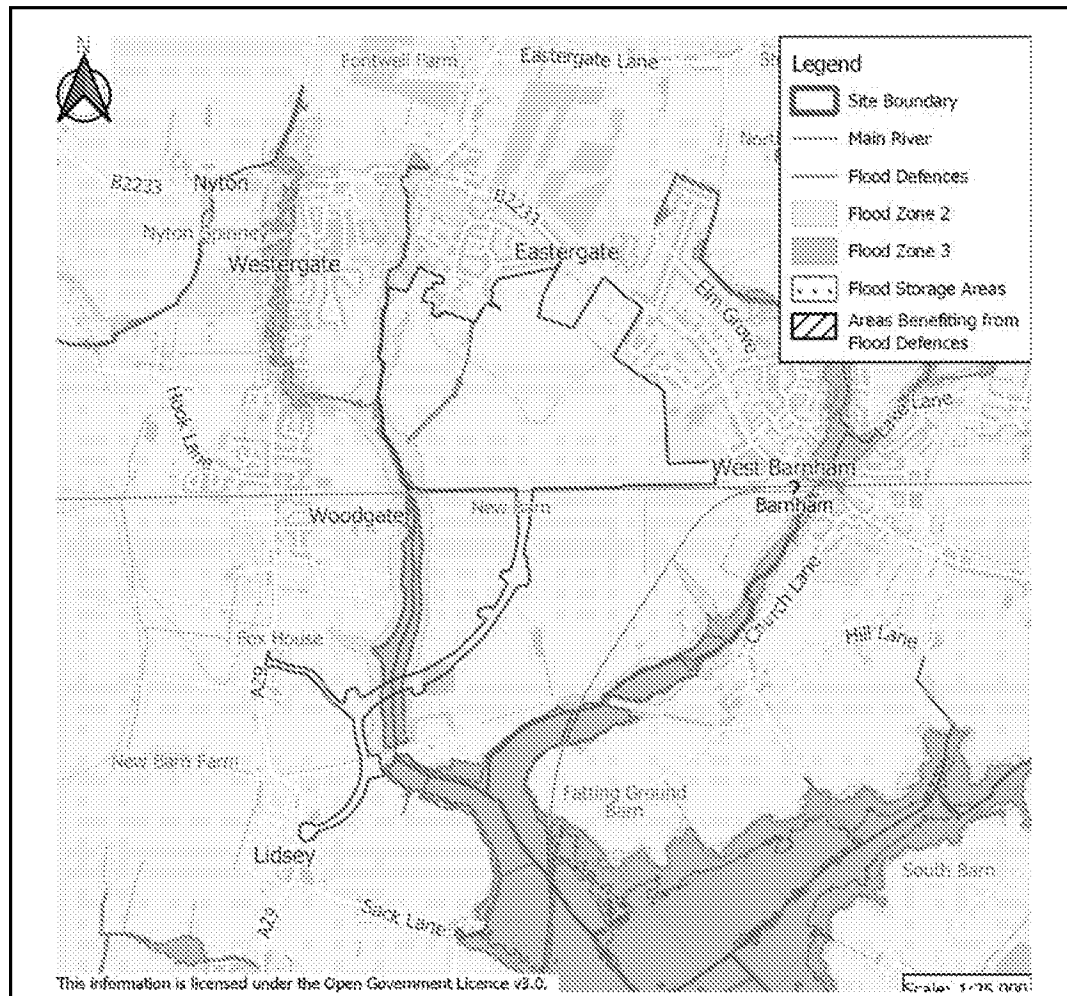
Figure K4.2 Groundwater Monitoring Locations



Flood Extents

- K4.25 The Flood Map for Planning is a resource prepared by the Environment Agency to identify areas that are at risk of flooding from rivers and the sea. This mapping confirms the Site to be largely in Flood Zone 1 (Low Probability) and so at low risk of flooding from fluvial and tidal sources.
- K4.26 However, there are extents of Flood Zone 2 and 3 across the site associated with the Lidsey Rife along the western boundary within a defined floodplain corridor parallel to the watercourse. Some floodplain also extends along the defined ditches with some connectivity to the Lidsey Rife mitigating the potential impact of fluvial flooding. An extract of this mapping is included as Figure K4.3.

Figure K4.3 Flood Map for Planning



K4.27 Therefore, there are extents of Flood Zone 2 and 3 applicable to the Development Site in terms of ES receptors. The the Proposed Development may affect flood risk elsewhere due to changes in natural floodplains of watercourses.

K4.28 Further assessment of the flood risks from other sources is discussed within the Flood Risk Assessment (Appendix K1).

Local Watercourses

K4.29 There is an engineered watercourse near the Northern boundary of the Development Site known as the 'School Stream' acting as a land drainage function for the on-site agricultural activities. This flows East and West towards a headwall inlet where flows enter a culvert. This culvert then routes through the Development Site to where it opens up just north of the railway, before passing under the rail embankment in another culvert before continuing to flow in open channel further south.

K4.30 There are several other unnamed watercourses across the site, most of which are often observed as dry land drainage ditches. Two of these drains have apparent connectivity to the Lidsey Rife and so have been termed as Lidsey Rife Tributary A and B as per the watercourse location plan in Figure K4.1. Lidsey Rife Tributary A and B do not appear to be directly connected to the

Lidsey Rife, rather the open channel stops short with no evidence of a positive connection located from site visits or mapping data although the culverted section is noted on records from Arun District Council. These watercourses may enter the Lidsey Rife through infiltration, or there may be historic culverts.

Sewerage Infrastructure

- K4.31 With reference to Southern Water's asset plan, there is a foul sewer that runs along the route of the Lidsey Rife valley, parallel to the watercourse to where it connects to the nearby Lidsey WwTW. There are also sewers located around the outside of the Development Site for pre-existing developments and for the farmhouses that sit around the perimeter of the site. It should be noted there are no sewers across most of the site which is currently actively farmed land.
- K4.32 It is understood the Development Site sits within the operational boundary catchment of Lidsey Wastewater Treatment Works (WwTW) and some initial phases may drain foul water to Lidsey if capacity exists at the time.
- K4.33 However, as previously mentioned, there have been ongoing discussions with Southern Water regarding a strategic solution to ensure adequate system capacity and disposal of foul water from the Development Site given its long-standing allocation within the Arun Local Plan 2011-2031. This solution would mean that foul water is drained to Ford Wastewater Treatment Works located approx. 4.5km to the east of the Development Site.

Water Supply

- K4.34 Potable Water supply in this area is provided by Portsmouth Water. Records show the presence of water mains running along the majority of the roads within and surrounding the existing developments near the Development Site. The area can be considered well served with potable water.
- K4.35 Whilst not specifically referenced by Portsmouth Water, the South Downs National Parks Authority Water Cycle Study (AMEC, April 2015) identified that Portsmouth Water had 'no deficit (large surplus)' when considering their baseline and forecast situations for water supply across their operational catchment.
- K4.36 Localised improvements may be required to reinforce the supply network of water mains.

Future Baseline

- K4.37 The future baseline considers how potential flood risk and river dynamics will be affected by climate change impacts on rainfall intensity, peak river flows and sea level change as determined in the NPPF. As it considers the impact of climate change, it is typically considered a long-term future baseline potentially occurring throughout the anticipated design life of a development. For instance, sea level rise is assessed up to the year 2115 as part of the enclosed FRA. In a broader context, the future baseline scenario should take into account other changes to the water environment such as changes to water quality, foul sewerage infrastructure and water supply demand.
- K4.38 Mapping included as part of the West Sussex SFRA includes an allowance for climate change when considering flood extents from rivers and the sea. Furthermore, site-specific information provided by the Environment Agency also includes climate change allowances on peak river flows in accordance with the latest standing guidance (Environment Agency, July 2020).
- K4.39 This can inform the future baseline for flood risk and is discussed in further detail as part of the Flood Risk Assessment.

- K4.40 The mapping demonstrates that the Development Site is shown to be affected by flooding when accounting for potential increases in river flows and sea level rise associated with climate change up to 2115, however the extent remains within the well-defined floodplain of the Lidsey Rife.
- K4.41 Connections to Southern Water’s public foul sewer network will continue in the interim as consented schemes in the area are constructed, and their planning for potential upgrades and development within the catchment will continue in accordance with their Asset Management Planning (AMP) periods and so depending on the timescales associated with this application, the ‘future baseline’ in respect of foul discharge points, capacity and treatment offered by the surrounding wastewater infrastructure may vary.
- K4.42 With reference to the water supply section above, the South Downs Water Cycle Study confirmed that the ‘future prediction’ of water supply for the Portsmouth Water area would suffer no deficit, and in fact have a large surplus.
- K4.43 Further assessment of flood risks from other sources are discussed within the Flood Risk Assessment (Appendix K1).

K5.0 Potential Effects

Built in Mitigation

- K5.1 As part of developing the masterplan for the scheme, there are several embedded mitigation measures related to flood risk and drainage that were secured through early involvement by Pell Frischmann.
- K5.2 Flood Zones and climate change floodplain extents were identified and provided as key development constraints to feed into wider development planning and layout. As such, the Proposed Development has adopted a sequential approach to layout, avoiding development within the floodplain wherever possible. All residential development and other more vulnerable uses are in Flood Zone 1.
- K5.3 As such, this is considered inherent mitigation for the risk of flooding posed to the area.
- K5.4 Furthermore, the culverted School Stream was identified as a development constraint and potential opportunity for daylighting in accordance with Local Policy. As such, plans have been developed to incorporate the daylighted watercourse into the landscaping proposals, improving its conveyance, capacity, amenity, and biodiversity and so impacts will be assessed accordingly.
- K5.5 The groundwater monitoring has also provided a detailed picture of flood risk issues from this source, embedding into the design suitable approaches i.e., no below-ground voids/basements and construction methods which require dewatering of trenches and excavations.
- K5.6 These considerations are embedded mitigation and therefore are assessed with these measures in place. The embedded mitigation will be secured through a combination of the CEMP and appropriate planning conditions discussed further in the mitigation section.
- K5.7 The Sustainable Drainage Report (Appendix K2) has, from project inception identifies a suitable strategy for the management of surface water from the Proposed Development. It sought to outline existing surface watersheds and retain these where possible to avoid localised issues with catchment transfer.
- K5.8 From these catchments, a suitable method of surface water disposal was identified to the relevant watercourses (with limited source control infiltration methods) together with a suitable maximum allowable discharge rate.
- K5.9 This discharge rate is equivalent to the pre-development greenfield QBAR rate and will be used to restrict runoff for all storm events, including appropriate increases in rainfall intensity to allow for the impacts of climate change. Allowance has also been made for urban creep within the Sustainable Drainage Report and the impacts this may cause within the development in line with West Sussex policy.
- K5.10 With the parameter plans, suitable space has been allocated to allow for the accommodation of strategic sustainable drainage features, such as ponds and basins that will accommodate the additional runoff generated by the Proposed Development, while discharging at the previously mentioned low rate.
- K5.11 Southern Water has been engaged throughout this project when developing a strategic solution to ensure suitable foul water drainage from the Proposed Development. Engineers from Pell Frischmann have worked with Southern Water to identify appropriate points of connection to the public sewerage network, and provided potential dwelling numbers and phasing arrangements to identify key trigger points that may require strategic upgrades. Through this consultation, Southern Water have identified there is capacity within their network for the anticipated flows, and strategic growth planning has already accounted for the Proposed

Development given its allocated status. Therefore, there is confidence that a suitable solution will be provided to ensure no adverse environmental impacts associated with the Proposed Development.

K5.12 Irrespective of the assumptions listed above, further pre-development enquiries may be needed, when more specific development proposals are brought forward, and if planning is approved detailed designs would include the necessary foul networks, including S104 applications for the adoption of sewers to ensure suitable drainage and no detrimental environmental impacts.

K5.13 The inclusion of a sustainable foul and surface water drainage strategy within the parameters of the Proposed Development is considered embedded mitigation and therefore the potential effects are assessed with this in place.

During Construction

Changes to Natural Drainage Regime

K5.14 During the construction phase, heavy machinery will be used across the Development Site, potentially resulting in the compaction of soil. This can reduce infiltration rates and has the potential to increase both the volume and rate of runoff into the local watercourses and sewers. This may result in short term changes to flow patterns and subsequently, increase flood risk further downstream.

K5.15 Uncontrolled increases in the rate and volume of surface water runoff from the Development Site could be considered a minor adverse impact due to its potential to locally alter flood risk. There are a few receptors immediately downstream that may be affected by an increase in runoff, namely the existing floodplain around the Lidsey Rife downstream of the railway. Most of this land is given over to agricultural use and therefore the receptor (existing undeveloped land) would be of 'Low' sensitivity. The resulting effect would therefore be of minor adverse significance. This effect would be considered indirect, would occur over the medium term and be permanent.

K5.16 Changes to the flow regimes of the smaller watercourses on site is considered to be of negligible impact on the overall WFD classification as they are largely agricultural ditches and so likely to experience substantial fluctuations in flow rates throughout the year, often experiencing periods of high flows in wetter periods and periods of drying. A negligible impact on a medium sensitivity receptor (the designated Lidsey Rife catchment) would be considered a minor adverse effect. The effect would be direct, experienced over the medium term and be permanent in nature.

Pollution Risk

K5.17 According to the CIRIA guidance on Control of Water Pollution, the most common instance of water pollution from construction sites is from suspended solids. Possible sources of suspended solids from the construction of the Proposed Development include:

- Earthworks and excavations
- Exposed ground, including material stockpiles
- Plant and wheel washing
- Build-up of dust and mud on haul roads
- Pumping of contaminated surface waters or groundwaters accumulate on the Development Site, and

- Disturbance of riverbeds and/or banks

- K5.18 Construction activity will also likely include removing topsoil and moving and storing earth within the Development Site boundary, resulting in volumes of unconsolidated material at the surface. Surface water runoff can erode these stockpiles and transport the sediment to the local watercourses. Indirect impacts may occur further downstream depending on the volume of sediment released, although it's likely the magnitude of impact would diminish further away from the Development Site.
- K5.19 Sedimentation of the Lidsey Rife and connected watercourses would be considered a moderate adverse impact due to its potential to affect the physio-chemical classifications under the WFD, and its potential to locally increase flood risk if sedimentation reduces the capacity of the channel and causes blockages to key structures. A moderate adverse impact on a moderate sensitivity receptor results in a moderate adverse effect and therefore requires further mitigation. The effect would be direct on the watercourse, occur over the short term and be temporary in nature.
- K5.20 Other instances of water pollution can occur from concrete and cement products, hydrocarbons, sewage, metals and other pollutants and hazardous materials generated during construction. These substances can enter the water environment through intrusive earthworks, leaks or spills and routine operations including vehicle and plant washing. The potentially hazardous nature of these types of pollutants means that their impact magnitude can be defined as moderate adverse.
- K5.21 Further pollutant hazards may come from the uncontrolled release of substances as general waste, solvents, cleaning agents, paints, and other chemicals. However, it is unlikely that bulk quantities of these substances would be present on the construction site, thus reducing the effect of their release.
- K5.22 The local watercourses are considered to have a medium sensitivity to potential changes, therefore prior to mitigation, any of the potential pollutants described above that may enter them would be defined as having moderate adverse effects without mitigation. The effect would be direct, occur in the short term and be permanent in nature due to the long-term impacts arising from watercourse pollution.
- K5.23 In the event that pollutants or contaminants enter the groundwater supply via leaching through the ground or through direct contamination of high groundwater levels, then there would be a moderate impact on the high sensitivity receptor, which would be classified as a moderate adverse significant effect. The effect would be direct, occur in the short term and be temporary in nature.

Flood Risk Impacts

- K5.24 The Development Site is mostly in Flood Zone 1, however, there is an area of Flood Zone 2 and 3 in a limited extent from the Lidsey Rife in the West of the site. Therefore, overall, the site is at low risk from flooding both from rivers and the sea. During the construction phase there may be localised areas of flooding associated with existing small culverts, or where the proposed haul road crossing may bridge the smaller watercourses on site. The current relatively poor condition may also lead to blockages or poor channel conveyance that may present localised out of bank flow of local watercourses.
- K5.25 Without mitigation, there is likely to be a minor adverse impact on medium sensitivity receptors such as the construction plant, machinery, and temporary buildings, resulting in an effect of minor adverse significance. The effect would be direct, medium term, and temporary in nature.

- K5.26 Due to the potential groundwater level across the Development Site, there may be a potential for flooding to occur within the construction site if groundwater level rise above the ground surface. Typically, groundwater flooding will be revealed by the onset of ponding on the ground surface, which increases in depth and spread over time rather than resulting in deep and/or fast-flowing water which is more typical of flooding from rivers. However, groundwater flooding usually occurs over a prolonged period and therefore may have longer-lasting impacts on construction activity.
- K5.27 This may have implications on material storage (initial placement or transporting if problems occur), construction workers when moving around site and the safety of the plant and other equipment.
- K5.28 Flooding may be more problematic in trenches or excavations where the depth of water may be more significant, causing issues around safety.
- K5.29 Groundwater flooding has the potential to result in a moderate impact (threat to human safety) on a very high sensitivity receptor (construction workers), which equates to a substantial adverse impact, when considering the impact of flooding on construction workers, but a moderate impact on low sensitivity receptors when considering the impact on plant and construction activities. Both effects are direct, could occur in the short terms and would be permanent in nature. The threat to the water environment through pollution of these groundwaters is discussed above.
- K5.30 A suitable dewatering strategy will need to be prepared as part of the CEMP to demonstrate how groundwater can be managed during the construction process to allow suitable formation of trenches and excavations. This will operate on a phased basis, dewatering only areas of excavation so flooding may still occur around other areas of the Development Site whilst dewatering takes place.
- K5.31 As part of the dewatering strategy, an abstraction licence will be required from the Environment Agency that will look to ensure no damage to the groundwater resource through abstraction via the dewatering activities. The consent will place a limit on the volume of the water that can be abstracted, although given the relatively high quantities and extensive spatial covering of the aquifer it is unlikely dewatering activities will have a discernible impact on groundwater.
- K5.32 When dewatering activity occurs, a discharge consent may also be needed when discharging the abstracted water into local surface water bodies, such as the local Rife and ditch systems. Again, a suitable discharge rate will be agreed, such that flood risk is not increased downstream as a result.
- K5.33 The embedded mitigation within this discrete activity (obtaining appropriate consents) will result in a negligible impact on a high sensitivity receptor, which equates to an effect of minor adverse significance. Effects would be indirect, occur in the medium term and be temporary in nature.

A29 Crossing

- K5.34 As part of the Proposed Development and route of the proposed A29, the A29 is required to cross over the Lidsey Rife. A 30m clear span bridge has been proposed which spans the width of the Lidsey Rife and a portion of the associated floodplain. This includes at least a 600mm freeboard space between the soffit of the bridge and the peak flood level of the Lidsey Rife.
- K5.35 During construction, workers will be subject to working within Flood Zones 2 and 3 where during rainfall events the ground may become unsuitable for work and flood in a short period of

time. This has the potential to become a moderate adverse impact on a very high sensitivity receptor if no mitigation measures are put in place due to the potential risk to construction workers. This would be considered a substantial adverse effect and will require suitable mitigation. The effect would be direct, occur in the short to medium term and be permanent.

- K5.36 Furthermore, during the construction phase, there is potential for a significant volume of material to be placed within the floodplain as the bridge approach embankments are constructed. As a result, sediment has the potential to enter the Lidsey Rife which may lead to sedimentation and blockages of key structures downstream. This would be a moderate adverse impact due to its potential to interfere with the watercourse's physio-chemical make-up as classified by the WFD on a medium sensitivity receptor. This would be classed as a moderate adverse effect, which would be direct in nature, occur in the short term and be temporary.

Deculverting School Stream

- K5.37 As part of the Proposed Development it is intended to divert the culverted section of the School Stream, returning it to open watercourse on a route around the edge of the Development Site. This will include adding approximately 560m of new surface watercourse to the site and expanding and improving the existing approximately 200m of surface watercourse.
- K5.38 During construction, formation of the watercourse channel is likely to give rise to a volume of unconsolidated material that may enter the existing watercourse, Sedimentation of the School Stream would be considered a minor adverse impact on a medium sensitivity receptor. This results in a minor adverse effect that would be considered a direct effect occurring in the short term and being temporary in nature.
- K5.39 Constructing the watercourse will also require some works to take place on existing watercourses, including the culvert. As such, there is potential for construction workers and plant and machinery to be in an area at risk of flooding. Depending on the sequencing and method of construction, there may also be a limited risk of short term, localised increases in flood risk if existing watercourses are stopped up, or pumping is required over coffer dams etc.
- K5.40 As before, there would be a moderate impact (threat to human safety) on a very high sensitivity receptor (construction workers), which equates to a substantial adverse impact when considering the impact of flooding on construction workers, but a moderate impact on medium sensitivity receptors when considering the impact on plant and construction activities, which is a moderate adverse effect. Both effects are direct, could occur in the short term and would be permanent in nature.

During Operation

- K5.41 During the operational phase of the development, the major impact will be an increase in surface water run-off due to the large areas of roofing and hard standing within the Proposed Development compared to its existing greenfield nature.

Impact of Runoff Quantity

- K5.42 As part of masterplanning the Proposed Development, embedded mitigation is incorporated within the design through the inclusion of various SuDS components, including strategic attenuation features in line with the recommendations set out in the Sustainable Drainage Report (Appendix K2).
- K5.43 The overarching aim of the surface water drainage strategy set out for the Proposed Development is to adhere to the 4 pillars of good SuDS designs set out in the CIRIA SuDS Manual. Discharge from the Proposed Development will be restricted to a low rate, equivalent to

the pre-development greenfield QBAR rate. This restricted rate will apply for all storm events up to and including the 100-year storms, with a 40% increase in rainfall intensity to all for the predicted future effects of climate change.

K5.44 The strategy has followed the hierarchy of discharge laid out in multiple guidance documents, including the WSCC SuDS design and adoption guide. Due to the potentially high groundwater levels, it is unlikely that infiltration can be used as the primary method for discharging surface water at a strategic scale across the Proposed Development, and so the strategy outlines an approach based on discharge to the nearby watercourses.

K5.45 These embedded mitigation measures will ensure no adverse flood risk impacts downstream resulting from a greater rate and volume of water entering the watercourse and may provide a beneficial impact by controlling runoff from a substantial area of the catchment. Whilst it cannot prevent flooding entirely, it will contribute to a negligible impact on a high sensitivity receptor comprising the existing Flood Zone 3 extents and existing properties within the floodplain, and so would be considered a minor beneficial effect. The effect would be indirect, occur in the long-term and be permanent in nature.

Impact on Runoff Quality

K5.46 A second pillar of good SuDS design includes improving water quality, using measures like the ones proposed, including swales, basins and ponds allowing for the deposition and trapping of sediment and particulate matter from urban runoff, with the periods of attenuation allowing for biological and natural breakdown of hydrocarbons and other soluble pollutants.

K5.47 A predominantly residential-led development such as the one proposed also has a limited number of pollutant sources, confined predominantly to accidental spilling and leakage from motor vehicles and mis-connections of wastewater pipes serving appliances such as dishwashers, washing machines and similar to the surface water system rather than the foul water system.

K5.48 The cessation of farming activity that releases nitrates and phosphates due to the use of fertilisers, means the operational phase of development would provide a moderate beneficial impact on a medium sensitivity receptor comprising the Lidsey Rife phosphate issue area. By removing a nitrate and phosphate source within the Lidsey Rife catchment, the potential for eutrophication in connected watercourses would be reduced, an issue the Environment Agency considers a significant concern to UK watercourses⁸, resulting in an effect of moderate beneficial significance. The effect would be indirect, occur in the long term and be permanent.

K5.49 Given the strategic importance of the proposed A29 route, the Highways England Water Risk Assessment Tool (HEWRAT) has been used to quantify the potential impact on water quality of the receiving watercourses specifically from the highway drainage scheme.

K5.50 As per the drainage strategy outlined within the Sustainable Drainage Report (Appendix K2) there are a total of 8 drainage catchments serving the A29 and key highway links. Of these 8 catchments, there are 3 receiving watercourses where outfalls are directed to, comprising: the Lidsey Rife, both directly and via Tributary B, Lidsey Rife Tributary A, and the School Stream.

K5.51 Full outputs from the HEWRAT analysis are included as Appendix K3, but in short, all catchments achieve a 'pass' when considering the acute impacts of copper and zinc on water quality and have limited chronic impacts on sediment. 'Alerts' are noted for the sediment impact as in almost all cases there exists a structure on the watercourse downstream of the drainage outfall. However, in most cases this is to be a new structure as part of the Proposed Development and as such would be designed to ensure minimum sediment build-up.

- K5.52 Therefore, it can be considered that the impacts on runoff quality from drainage associated with the proposed A29 would be negligible, resulting in a neutral significance.

Flood Risk Impacts

- K5.53 The Development Site is largely in Flood Zone 1, with Flood Zone 3 immediately surrounding the Lidsey Rife, and so considered at low risk from flooding from fluvial and tidal sources. As part of the Flood Risk Assessment (Appendix K1) several improvements to local watercourses have been recommended to remove overgrown vegetation, remove unnecessary culverts and other structures and to improve conveyance secured through appropriate consultation with stakeholders and local authorities.
- K5.54 Due to the location of several small watercourses on site, it is likely that crossings will be required where proposed highway infrastructure needs to cross the watercourses. Prior to mitigation, these crossings may have an impact on the conveyance of flow within the watercourse channel, resulting in potential localised increases in flood risk. This could be considered a moderate adverse impact on a medium sensitivity receptor resulting in an effect of moderate adverse significance. These effects would be direct, short term and permanent.
- K5.55 A residual risk may occur during the operational phase due to flooding from groundwater if elevated levels are experienced. Without mitigation, the risk of groundwater flooding may result in a moderate adverse impact on a high sensitivity receptor (residential dwellings), equating to an effect of moderate adverse significance. The effect would be indirect, occur in the long term and be temporary in nature.

Foul Sewerage

- K5.56 The Development Site is located within the foul drainage catchment of Lidsey Wastewater Treatment Works, owned and operated by Southern Water. Lidsey WwTW currently discharges treated effluent via the Lidsey Rife and eventually into the English Channel, which has areas designated as Marine Conservation Zones and a Special Protection Areas (Marine Components) nearby.
- K5.57 Due to capacity being reached, Lidsey WwTW is unable to accept any foul water due to be released from the Development Site. The wastewater produced will be pumped from Lidsey WwTW across the District to be process and subsequently discharged by Ford WwTW approximately 5km away from Lidsey WwTW. Ford WwTW has the available capacity to take, treat and discharge the foul water produced by the Development Site.
- K5.58 It is understood there are currently no permitted limits on nitrogen or phosphorus loading in discharged effluent from Lidsey WwTW but there are permitted limits on ammonia, BOD and rate/volume of discharge.
- K5.59 From consultation with Southern Water, it is understood that Ford currently has substantial hydraulic capacity to receive additional flows from new development, and that under normal operating procedures also operates within its permitted limits for quality of effluent. Therefore, as a receptor for foul flows, it is of 'Low' sensitivity and the moderate adverse impact of conveying additional flow to it would equate to a minor adverse effect. These effects would be indirect, occur in the medium term and be permanent in nature.
- K5.60 However, as Ford Wastewater Treatment Works discharges to the River Arun transitional waterbody, a 'medium' sensitivity receptor, any potential impacts to the water quality or WFD classification as a result of the Proposed Development could be classed as a moderate adverse impact that equates to a moderate adverse effect. The effects would be indirect, occur in the medium term and be permanent in nature.

- K5.61 In the event that flows (either in part or if capacity is released by other means) are directed to Lidsey WwTW, it can be considered that there would be a moderate adverse impact on a medium sensitivity receptor (the Lidsey Rife WFD classified water body). This would be a moderate adverse effect.
- K5.62 Therefore, in either case, without mitigation the potential impact from foul sewerage would be considered a moderate adverse impact on a medium sensitivity receptor and so classed as a moderate adverse effect. The effects would be indirect, occur over the long term and be permanent in nature. Mitigation is therefore required to prevent significant environmental impacts.

Water Supply

- K5.63 During the operation phase, the Proposed Development will generate a water supply demand for the new properties. As previously mentioned, Portsmouth Water supply water to the area and currently anticipate a large surplus of water supplies from their catchment area. Much of their supply is derived from groundwater abstraction which is abundant in the area.
- K5.64 Network reinforcements may be required to supply infrastructure in the area, but it is anticipated that supply can be accommodated in a sustainable way.
- K5.65 Therefore, there it is a minor adverse impact on a low sensitivity receptor, resulting in a neutral effect. Any effect would be indirect, long term and permanent.

A29 Crossing

- K5.66 As part of the Proposed Development, the A29 will be diverted and a bridge crossing the Lidsey Rife will be installed. Indicative designs incorporate a 30m wide free spanning structure over the Lidsey Rife and immediately adjacent floodplain. Where the remaining structure crosses the floodplain, it will do so via an earth embankment situated within the extreme floodplain outlines. The design ensures a suitable freeboard above the modelled flood levels with no significant impact on third party land. The bridge span does not cover the entire floodplain; however, modelling shows no impact.
- K5.67 The main Lidsey Rife channel will not be impacted by the introduction of a free-spanning bridge, apart from a short reach underneath the bridge which will be subjected to increased shadowing. However, in normal conditions the height of the bridge above the normal water level and significant span should still allow suitable vegetation growth and habitat coverage.
- K5.68 During operation, the impacts of the crossing would be negligible due to the significant span over the channel and immediate floodplain, resulting in a neutral significance impact. Effects would be direct, short term and permanent.

Deculverting School Stream

- K5.69 The Proposed Development also includes proposals to deculvert the School Stream and provide a suitable diverted route within the landscaping associated with the Proposed Development. This will lead to approximately 760m of open watercourse around the site, of which 560m will be new open watercourse and approximately 200m of reprofiled and improved existing watercourse along the northern boundary. This will also eliminate the need for the on-site culvert which is considered a poor-quality watercourse with low biodiversity and amenity value.
- K5.70 The newly diverted School Stream will be suitably designed to provide capacity for design flood flows including climate change, will create new habitats and improved biodiversity and amenity in the area, whilst also improving the water quality by allowing a natural breakdown of hydrocarbons and pollutants which negatively impact water quality.

K5.71 Overall, the introduction of a significant new length of open watercourse, replacing the existing culvert would have a moderate beneficial impact on a medium sensitivity receptor, resulting in a moderate beneficial effect. The effect would be direct, occur in the medium term and be permanent in nature.

K6.0 Mitigation and Monitoring

During Construction

- K6.1 A Construction Environment Management Plan (CEMP) based on the outline CEMP at Appendix C3 is proposed to demonstrate the proposed environmental management practice that will be required of contractors employed to undertake the construction work. This will be controlled by planning condition. The CEMP is proposed to contain several elements as set out below.

Changes to Natural Drainage Regime

- K6.2 To reduce the potential for large machinery to compact soils in an uncontrolled manner across the construction site resulting in an increase in the rate and volume of surface water, the movements of heavy plant, machinery and site vehicles should be managed as part of the CEMP, for which the principal contractor will be responsible. Creating designated pathways and haul roads along high-trafficked routes will minimise the impact on soil compaction and surface disturbance and reduce the overall area affected.
- K6.3 To prevent localised flooding during the construction phase, a temporary surface water management system should be put in place and enforced by the CEMP at the outset of construction activity. This would include swales and basins around any compounds to provide temporary on-site attenuation. This enabling works package for each phase of development should also prioritise formation of the drainage features so these are installed and operation as early as possible.

Pollution Risk

- K6.4 The CEMP will be in place to guide contractors to follow best practice principles. To mitigate the potential pollution risks during the construction phase, simple measure can be employed on site and adopted as part of the site procedures and CEMP.
- K6.5 During construction of the enabling infrastructure, the haul roads will be kept clear of mud deposits and pedestrian routes will be set up and maintained. Haul roads should be damped down during dry and windy periods to minimise dust. A road sweeper will also be employed at regular intervals to keep the adjacent public roads clear of mud and construction related debris.
- K6.6 Any water arising from dewatering activities should be filtered and/or passed through a stilling basin to allow suspended solids to settle out prior to discharge to relevant local waterbodies.
- K6.7 To reduce the potential impact of leaks and spills of oils, fuels and other contaminants from plant and machinery, machines should be regularly checked for signs of wear and tear and anything of note recorded regarding condition.
- K6.8 Vehicle washdown areas should be bunded and runoff routed through interceptors.
- K6.9 If oils or fuels are to be stored in bulk quantities on the Proposed Development site, the storage facilities should comply with the Environment Agency's Pollution Prevention Guidance Note 2 where bund storage capacity should be 110% the max capacity of the storage device.
- K6.10 Refuelling facilities should comply with Pollution Prevention Guidance Note 7, with regular testing of the storage tanks and pipes and all refuelling activities taking place over an impermeable area which should drain off through an oil separator.

- K6.11 Any wastewater from the washing down of ready-mix concrete lorries or from the production of concrete on site should be carried out in a designated area where wastewater is unable to enter the surface water environment without being treated prior to release.
- K6.12 Any watercourse crossings required to access parts of the construction site will require a suitable culverted crossing and localised construction activity within and close to the banks. Such work will require appropriate land drainage consent issued by Arun District Council, with any works identified in advance to allow suitable timescales for submission and approval of the relevant consents. This will ensure suitable construction methods and design of culverts, even if only for temporary work.

Flood Risk Impacts

- K6.13 As discussed, the Development Site is generally at low risk of flooding from fluvial sources. Localised flood risk issues may occur near these watercourses, so it is recommended that construction compounds, material stockpiles, car parks, site offices and other structures are positioned away from the banks of the watercourses wherever possible.
- K6.14 Ongoing monitoring of groundwater levels, using telemetry where possible, should be carried out throughout the construction process. The existing groundwater boreholes could be used, if not decommissioned, so that appropriate trigger levels can be identified when flooding from groundwater may be likely.
- K6.15 The CEMP should use this data to prepare suitable emergency and contingency procedures that will be engaged if flooding is predicted, expected, or occurring. The principle aim would be to protect human health and safety by ensuring no activity is taking place in areas where water collected on the surface at depth, including trenches and excavated areas. Subsequent measures should look to protect property (plant, machinery, and materials) to prevent damage and pollution of the water environment through the uncontrolled release of contaminants.
- K6.16 A suitable dewatering strategy should be put in place for construction activities that would manage the risk of flooding to areas undergoing this specific process, but there remains a residual risk to the wider Development Site from groundwater emergence.
- K6.17 As part of the site inductions and training, construction staff should be advised on how to react during a flood event and be aware of the elevated risk of groundwater emergence so they can plan and prepare accordingly.

A29 Crossing

- K6.18 The CEMP should ensure suitable measures are incorporated when considering working in or near the Lidsey Rife to ensure any impacts associated with this crossing are managed appropriately. This would include suitable sediment management techniques to ensure any sediment is trapped prior to entering the watercourse or flowing downstream.
- K6.19 Measures such as hay bales or silt curtains installed in the watercourse can help prevent impacts offsite, while appropriate storage and movement of material on the banks can limit the potential for it to enter the watercourse.

Deculverting School Stream

- K6.20 The deculverting and diversion works around the School Stream will also require suitable measures outlined in the CEMP. Works to the ordinary watercourse will also firstly require appropriate land drainage consent sought from Arun District Council, which will outline in detail the sequencing and methods of construction and mitigation measures employed.

- K6.21 The main risks with diverting the watercourse comprise mobilisation of sediment from the earthworks exercise and disturbance to the current channel and localised flood risk to construction activity in and near to the stream.
- K6.22 As such, suitable mitigation should be employed to manage sediment to deter it from entering the watercourse and providing suitable guidance and advice to construction workers carrying out the physical works.

During Operation

Impact on Runoff Quantity and Quality

- K6.23 The potential impacts on the water environment from runoff during the operational phase have been addressed via the embedded mitigation of the surface water drainage strategy and therefore no further mitigation is necessary. The mitigation will be secured through implementation of detailed design in accordance with conditions.

Flood Risk Impacts

- K6.24 Suitable building design, including avoiding basements or sub-ground levels should largely mitigate the risk of groundwater flooding experienced at the Development Site. This should be secured through appropriate conditions and is established as part of the currently submitted parameters, plans and design guides. Ongoing monitoring in the wider area by West Sussex County Council and Arun District Council will help to inform current and future risks from this source and input to a strategic solution for the management of the water table.
- K6.25 The surface water drainage strategy will also provide some management and control of flows within the remaining watercourses on the Development Site, reducing the potential flood risk from these sources. Any new culverts, crossings or other structures should be designed in such a way as to minimise the risk of blockage and offer a design that provides ease of maintenance. For all new structures, an appropriate body should be identified for the ownership and maintenance of these assets to ensure ongoing suitable maintenance activities.
- K6.26 The mitigation will be secured through appropriate planning conditions related to the detailed design and compliance with the recommendations of the FRA.

Foul Sewerage

- K6.27 Southern Water have actively been consulted and have identified Ford WwTW as a suitable receptor to treat foul flows from the Proposed Development to ensure the most effective and adequate wastewater treatment capacity to serve the Development Site and the wider BEW allocation. This is due to a current lack of capacity for treatment at the Lidsey WwTW.
- K6.28 The Development Site has a history of allocation within the Local Plan as the Barnham Eastergate Westergate Allocation, and such has been addressed within Southern Water's strategic group planning of the latest AMP cycle, and therefore upgrades should be provided to accommodate this growth.
- K6.29 Any strategic solution for wastewater treatment implemented by Southern Water will be done in such a way that it manages, and where possible, reduces the impact of treated effluent discharge on the receiving waterbodies, and will need to be completed within a defined period of time following the scheme securing planning permission in accordance with their obligations under the Water Industry Act. The likelihood of a strategic solution being brought forward is therefore very high and will be secured through appropriate planning conditions and detailed design of the on-site foul water network.

K7.0 Residual Effects

During Construction

- K7.1 Suitable construction management processes would ensure that potential impact on the changes to the natural drainage regime during the construction phase are limited to impacts of negligible magnitude, that would result in a neutral effect on flood risk and water quality of the surrounding water bodies.
- K7.2 With suitable pollution prevention measures in place across the Proposed Development, the potential impact magnitude arising from the pollution risk would be considered a negligible impact due to the control of pollution risks, limiting the sources of contamination. The residual effect would therefore be of minor adverse significance.
- K7.3 With construction management processes and pollution prevention measure put in place as previously mentioned the residual impacts from the A29 crossing and deculverting of the School Stream can be sustainably managed and mitigated. The residual effects will therefore be of minor adverse significance.

During Operation

- K7.4 The residual effects during operation are largely beneficial, comprising sustainable management of surface water across the Proposed Development, that will result in localised reductions in flood risk, improvements to water quality and a reduction in the potential agricultural nitrate and phosphate pollution within the catchment.
- K7.5 Therefore, these impacts are considered to have a minor beneficial impact, resulting in an effect of minor beneficial significance.
- K7.6 Improvements to facilitate wastewater treatment capacity are also likely to lead to the reduction or improvement in current impact on further downstream watercourses. The mechanisms by which this is secured are already in progress through Southern Water proposing to direct flows to Ford WwTW where there is adequate capacity. This is in line with their requirement to carry out upgrade works upon approval meaning it is very likely these measures will be in place and therefore a neutral impact is predicted in this regard.
- K7.7 The effects associated with the operation of the School Stream are of moderate beneficial significance due to the substantial benefits associated with providing an open watercourse to replace a culverted watercourse currently in poor condition.
- K7.8 The effects associated with the crossing of the A29 over the Lidsey Rife are considered to be negligible given the inherent mitigation by design, and limited impact on the floodplain as outlined in the Flood Risk Assessment.

K8.0 Summary & Conclusions

- K8.1 This chapter of the Environmental Statement has assessed the Proposed Development's potential impact on the water environment, including local watercourses, changes to the runoff regime, flood risk issues, foul water disposal, and water supply during the construction and operational phases.
- K8.2 Embedded mitigation is provided in the form of a sustainable surface water strategy incorporated throughout the masterplanning process. This aimed to set out a strategy to manage surface water generated by the Proposed Development in a sustainable way. This leads to improvements in water quality and reduction in flood risk though the control of runoff to the pre-development Greenfield QBAR rate.
- K8.3 Southern Water are the responsible authority for wastewater disposal at the Development Site. A strategic approach to managing foul flows remains under investigation, but Southern Water remain confident a suitable solution can be provided within the timescales of the application and within their obligations under the Water Industry Act through diversion of flows to Ford WwTW. The possibility of mitigation being put in place is therefore considered very high, and the potential effects of the Proposed Development will be managed.
- K8.4 The assessment concludes that no 'significant' environmental impacts are predicted with the prescribed mitigation in place. A summary of the ES Chapter impacts, mitigation, and residual effects is provided in Table K8.1

Table K8.1 Summary of effects

Impact Assessed	Receptor (Sensitivity)	Potential Effect (Magnitude & Significance)	Mitigation	Residual Effect (Magnitude & Significance)
Construction Phase				
Uncontrolled increases in the rate and volume of surface water increasing flood risk elsewhere	Existing undeveloped land downstream (Low)	Minor adverse impact resulting in minor adverse significance. Indirect, Long-term, permanent.	CEMP identifying haul roads and restricting movement to minimise impact on soil compaction and surface disturbance.	Negligible impact resulting in neutral significance.
Changes to flow regimes in watercourses due to changes to the natural drainage regime	Lidsey Rife designated water body (Medium)	Negligible impact resulting in minor adverse significance. Direct, long term, permanent.	Temporary surface water management system in place, secured by CEMP.	Negligible impact resulting in minor adverse significance.
Sedimentation of the Lidsey Rife through construction activity disturbing soils and other bare surfaces.	Lidsey Rife designated water body (Medium)	Moderate adverse impact resulting in moderate adverse significance. Direct, short term, temporary.	Pollution control measures identified in CEMP.	Negligible impact resulting in minor adverse significance.
Specific pollutants entering surface water bodies due to presence on site	Lidsey Rife designated water body (Medium)	Moderate adverse impact leading to moderate adverse	Pollution control measures identified in CEMP.	Negligible impact resulting in minor

Impact Assessed	Receptor (Sensitivity)	Potential Effect (Magnitude & Significance)	Mitigation	Residual Effect (Magnitude & Significance)
(oils, hydrocarbons, solvents etc.)		significance. Direct, short term, permanent.		adverse significance.
Specific pollutants entering the groundwater body due to presence on site (oils, hydrocarbons, solvents etc.)	Groundwater (High)	Moderate adverse impact resulting in moderate adverse significance. Direct, short term, temporary.	Pollution control measures identified in CEMP.	Negligible impact resulting in minor adverse significance.
Localised areas of flood risk due to construction impacts on small watercourses and existing structures in poor condition.	Construction plant, machinery, and temporary buildings (Medium)	Minor adverse impact resulting in minor adverse significance. Direct, long term, temporary.	Site induction information to identify local watercourses. Emergency plans and contingency measures employed as part of CEMP.	Negligible impact resulting in minor adverse significance.
Groundwater flooding impacts on overall site operations, particularly in trenches or excavations.	Construction workers (Very High), construction plant, machinery and temporary buildings (Medium)	Moderate impact resulting in substantial adverse significance to construction workers and moderate adverse significance to plant etc. Direct, short term and permanent.	Ongoing monitoring of groundwater levels during construction period. CEMP to identify emergency plans and contingency measures in case of flooding.	Negligible impact resulting in minor adverse significance.
Dewatering strategy (embedded mitigation) abstracting groundwater reserves and discharging elsewhere changing local flood risk dynamics.	Groundwater (High)	Negligible impact resulting in minor adverse significance. Indirect, medium term, temporary.	Dewatering strategy prepared as part of CEMP. Relevant consents and permits also sought.	Negligible impact resulting in minor adverse significance.
Construction activity taking place in Flood Zones specifically associated with the A29 crossing.	Construction workers (very high)	Moderate adverse impact resulting in substantial adverse significance. Direct, short-medium term, permanent.	Flood risk management measures identified in CEMP.	Negligible impact resulting in minor adverse significance.
Sedimentation of the Lidsey Rife due to material stockpiles in the floodplain	Lidsey Rife designated water body (Medium)	Moderate adverse impact resulting in a moderate adverse significance. Direct, short term, temporary.	Pollution control measures identified in CEMP.	Negligible impact resulting in minor adverse significance.

Impact Assessed	Receptor (Sensitivity)	Potential Effect (Magnitude & Significance)	Mitigation	Residual Effect (Magnitude & Significance)
associated with the A29 crossing.				
Sedimentation of the School Stream arising from works to deculvert current stretch and provide new open section.	School Stream (Medium)	Minor adverse impact resulting in minor adverse significance. Direct, short term, temporary.	Pollution control measures identified in CEMP.	Negligible impact resulting in minor adverse significance.
Potential for working in an area with high flood risk potential when diverting the School Stream.	Construction workers (very high), construction plant and machinery (Medium)	Moderate impact resulting in substantial adverse significance to construction workers and moderate adverse significance to plant etc. Direct, short term and permanent.	Site induction information to identify local watercourses. Emergency plans and contingency measures employed as part of CEMP.	Negligible impact resulting in minor adverse significance.
Operational Phase				
Sustainable drainage strategy restricting runoff leaving the site to a low rate, contributing to a reduction in flood risk downstream.	Flood Zone 3 and existing properties (High)	Minor beneficial impact resulting in moderate beneficial significance. Indirect, long term, permanent.	Mitigation embedded by design, secured through appropriate planning conditions.	Moderate beneficial significance.
Impact on runoff quality through cessation of farming activity and inclusion of SuDS to manage water quality.	Lidsey Rife designated water body (Medium)	Moderate beneficial impact resulting in moderate beneficial significance. Indirect, long term, permanent.	Mitigation embedded by design, secured through appropriate planning conditions.	Moderate beneficial significance.
Impact of runoff quality specifically due to highway runoff from A29.	Lidsey Rife designated water body (Medium), School Stream (Medium) other water bodies (Low)	Negligible impact resulting in neutral significance.	Mitigation embedded by design, secured through appropriate planning conditions.	Neutral significance.
New crossing installed on smaller watercourses and land drains has potentially to locally alter flood risk due to blockages or	School Stream (Medium), proposed landscaping areas (Medium)	Moderate adverse impact resulting in moderate adverse significance. Direct, short term, permanent.	Appropriate design of culverts/crossings, to be agreed at detailed design. Secured through planning conditions.	Negligible impact resulting in minor adverse significance.

Impact Assessed	Receptor (Sensitivity)	Potential Effect (Magnitude & Significance)	Mitigation	Residual Effect (Magnitude & Significance)
reduced conveyance.				
Residual risk of flooding due to rising groundwater.	New properties (High)	Moderate adverse impact resulting in moderate adverse significance. Indirect, long term and temporary.	Long term monitoring of groundwater, other recommendations in FRA. Secured through appropriate planning conditions.	Negligible impact resulting in minor adverse significance.
Hydraulic capacity of Ford Wastewater Treatment Works to receive foul flows from proposed development.	Ford WwTW (Low)	Moderate adverse impact resulting in minor adverse significance. Indirect, medium term, permanent.	Requirement imposed on Southern Water as local sewerage company to receive and treat flows. Strategic improvements to hydraulic and treatment capacity being brought forward by Southern Water as part of AMP period and investment.	Minor impact resulting in minor adverse significance.
Ford WwTW discharge of treated effluent affecting water quality of receiving system	River Arun transitional water body (Medium)	Moderate adverse impact resulting in moderate adverse significance. Indirect, medium term, permanent.	Requirement imposed on Southern Water as local sewerage company to receive and treat flows. Strategic improvements to hydraulic and treatment capacity being brought forward by Southern Water as part of AMP period and investment.	Minor impact resulting in minor adverse significance.
Possibility of some flows being directed to Lidsey WwTW if capacity is released and resulting impact on water quality from discharged effluent.	Lidsey Rife designated water body (Medium)	Moderate adverse impact resulting in moderate adverse significance. Indirect, medium term, permanent.	Requirement imposed on Southern Water as local sewerage company to receive and treat flows. Strategic improvements to hydraulic and treatment capacity being brought forward by Southern Water as part of AMP period and investment.	Minor impact resulting in minor adverse significance.
Water supply demand generated by proposed development.	Water supply infrastructure (Low)	Minor adverse impact resulting in neutral significance. Indirect, long term, permanent.	None required.	Neutral significance.
A29 crossing over the Lidsey Rife and floodplain, impacting conveyance and flood risk.	Lidsey Rife (Medium)	Negligible impact resulting in neutral significance. Direct, short term, permanent.	Suitable design put forward, to be secured through planning conditions.	Neutral significance.

Impact Assessed	Receptor (Sensitivity)	Potential Effect (Magnitude & Significance)	Mitigation	Residual Effect (Magnitude & Significance)
Introduction of a significant new length of open watercourse by removing culverted section of School Stream.	School Stream (Medium)	Moderate beneficial impact resulting in moderate beneficial significance. Direct, medium term, permanent.	Suitable design put forward, to be secured through planning conditions.	Moderate beneficial significance.

K9.0

Abbreviations & Definitions

- 1 SFRA – Strategic Flood Risk Assessment
- 2 PFRA – Preliminary Flood Risk Assessment
- 3 SuDS – Sustainable Drainage Systems
- 4 CFMP – Catchment Flood Management Plan
- 5 RBMP – River Basin Management Plan
- 6 SWMP – Surface Water Management Plan
- 7 WwTW – Wastewater Treatment Works

K10.0

References

- 1 JBA Consulting (2016); “Arun District Council: Level 1 and Level 2 Strategic Flood Risk Assessment; Final Report”; dated November 2016
- 2 West Sussex County Council (2011); “West Sussex Preliminary Flood Risk Assessment”; dated May 2011
- 3 West Sussex County Council (2014); “Lidsey Surface Water Management Plan”; A partnership between West Sussex County Council, Southern Water, Arun District Council, Environment Agency; dated October 2014
- 4 Environment Agency (2009); “Arun and Western Streams Catchment Flood Management Plan”; Summary report dated December 2009
- 5 West Sussex County Council (2018); “West Sussex LLFA Policy for the Management of Surface Water”; updated November 2018
- 6 CIRIA (2015); “The SuDS Manual – CIRIA Report C753”; published 2015.
- 7 Environment Agency (2016); “Flood risk assessments: climate change allowances”; last updated October 2021
- 8 Environment Agency (2019); “Phosphorus and Freshwater Eutrophication Pressure Narrative”; published October 2019
- 9 DEFRA and Environment Agency “Catchment Data Explorer” available from; <https://environment.data.gov.uk/catchment-planning>